# Fact Sheet on Mixed Oxide Fuel

## Background

With the end of the Cold War, the United States and the former Soviet Union began dismantling thousands of nuclear weapons. This dismantlement resulted in large quantities of surplus weapons-usable highly enriched uranium and plutonium. Proper safeguards and management are needed to address the concerns these excess materials raise regarding environmental, health, safety, and safeguards issues.

One of the challenges is how to dispose of this surplus material so that the accessibility and attractiveness for retrieval and future use in weapons is significantly reduced. In September 2000, the United States and Russia signed an agreement committing each country to dispose of 34 metric tons of surplus plutonium. Initially, the U.S. Department of Energy (DOE) developed a hybrid strategy for the disposition of U.S. surplus weapons-usable plutonium that used both immobilization and conversion to mixed oxide fuel and irradiating the fuel in a commercial reactor. One aspect of the strategy was immobilizing the plutonium in a ceramic form surrounded by vitrified high level waste for ultimate disposal in a geologic repository. The second aspect of the strategy is using the plutonium in fuel for a power reactor, in a once-through process. Both technologies would convert the plutonium to a form as inaccessible and unattractive for retrieval and weapons use as the residual plutonium in spent fuel from commercial reactors. On January 23, 2002, however, DOE announced that it no longer plans to immobilize the plutonium and will only pursue converting the plutonium to reactor fuel.

## Discussion

In November 1999, DOE published a Surplus Plutonium Disposition Final Environmental Impact Statement (Final EIS). The Final EIS analyzed the impacts of three facilities for the disposition of surplus plutonium, including mixed oxide (MOX) fuel fabrication and the associated impacts of using MOX fuel in nuclear reactors.

In January 2000, DOE issued a Record of Decision (ROD) for the Final EIS that identified a hybrid approach to dispose of up to 50 metric tons of surplus United States weapons plutonium and to construct and operate three new facilities at its Savannah River Site. This strategy involves (1) immobilization, in which up to 17 metric tons of surplus plutonium is mixed with ceramic and then surrounded by vitrified high-level radioactive waste, and (2) irradiation, in which up to 33 metric tons of surplus plutonium is mixed with uranium and converted to MOX fuel and used as fuel in existing U.S. commercial nuclear reactors. Ultimately, both approaches would involve disposal in a geologic repository pursuant to the Nuclear Waste Policy Act.

In June 2000, DOE published its Strategic Plan that describes plans for both the U.S. and Russia to disposition surplus fissile materials.

European countries such as the United Kingdom, Germany, Belgium, and France have been fabricating MOX fuel for many years. Commercial MOX-fueled light water reactors are used in France, United Kingdom, Germany, Switzerland, and Belgium. In the U.S., MOX fuel was fabricated and used in several commercial reactors in the 1970s, as part of a development program.

## Use in U.S. Reactors

Surplus plutonium would be fabricated with uranium into MOX fuel. The MOX fuel would then be used as fuel in the Catawba and McGuire commercial power reactors. There would be no reprocessing or subsequent reuse of this spent fuel (once-through fuel cycle). Using the plutonium in the reactor as MOX fuel makes using it for any other purposes difficult. Once the cycle is completed, the spent MOX fuel would ultimately be disposed of in a geologic repository.

## MOX Facility

In March 1999, DOE signed a contract with a consortium comprised of Duke, Cogema, and Stone & Webster (DCS) to (a) design commercial MOX fuel; (b) design, construct, operate, and deactivate a MOX fuel fabrication facility; (c) design and execute the reactor modifications necessary for use of MOX fuel; and (d) provide the architect/engineering and construction management services associated with these activities.

The MOX fabrication facility will be U.S. Government-owned and located at a DOE site at Savannah River, South Carolina. It will be used only for the purpose of disposition of the surplus plutonium. The fabrication of the MOX fuel at this facility will be subject to Nuclear Regulatory Commission (NRC) requirements. The facility will be shut down when the plutonium disposition is completed.

## NRC Role

The Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (sec. 3134) provided the NRC with the regulatory and licensing authority over the MOX fuel fabrication facility. The NRC also regulates the commercial reactors that would use the MOX fuel. The NRC anticipates licensing the MOX fuel fabrication facility under existing regulations. If the MOX fuel fabrication facility is built, the NRC will perform inspections during construction and operation.

## Current Status

DCS submitted an environmental report in December 2000, and an application to construct a MOX fuel fabrication facility to the NRC in February 2001. The NRC has developed a facility-specific Standard Review Plan (NUREG-1718) to assist the NRC staff in its review of the application. DCS submitted a revised application on October 31, 2002.

The NRC issued a draft Safety Evaluation Report (SER) on April 30, 2002, and a revised draft SER on April 30, 2003. The NRC plans to issue a final SER on December 5, 2003. The staff issued a draft Environmental Impact Statement (EIS) on February 20, 2003, and plans to issue a final EIS on November 28, 2003.

## Additional Information

Additional information on a possible mixed oxide fuel fabrication facility will be available on the NRC Web site in the near future.

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